**OKI**

People to People Technology

# Serial Interface Specifications

## for Microline 9-/24-Pin Printers

The information in this chapter applies to the following printers:

- ML 320/321, ML 3320/3321, ML 520/521, ML 320 FB
- ML 385/386, ML 390/391, ML 3390/3391, ML 590/591
- ML 390 FB

# Table of Contents

# Preliminary

The printer's interface has to be configured according to the specifications of your computer system. This is particularly important when using a serial interface.

One prerequisite for making up an interface cable is basic knowledge about interface signals and wiring. You should also be familiar with the use of soldering irons.

Otherwise the purchase of an interface cable is recommended.

## RS-232C Serial Interface

In a serial interface the bits of one byte are transmitted consecutively. Additional lines control the flow of data. This type of connection is often used with networks. Using a serial interface large distances can be covered without any disturbances.

When using a serial interface, correct wiring as well as correct setting of the interface parameters (configuration) is of paramount importance.

*Interface boards may vary in design.*
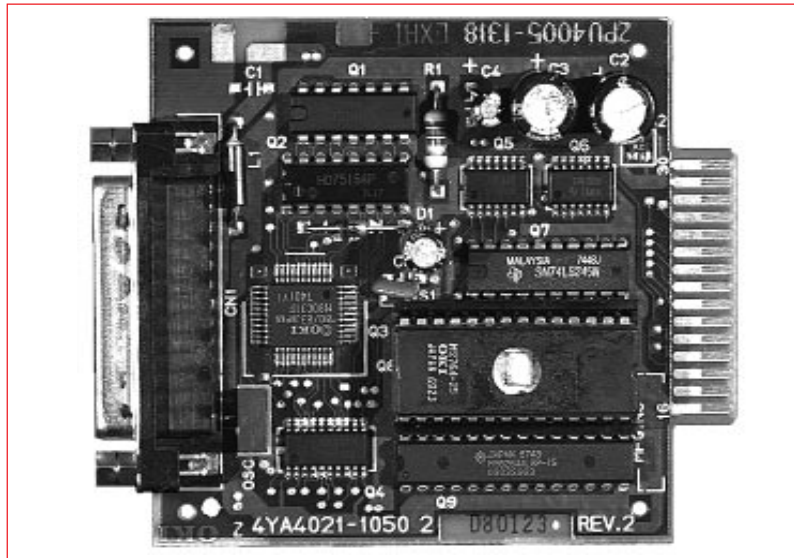
For most applications the default settings are sufficient. Occasionally you might have to change some parameters. Never change values which are not described in your computer or network manual.

Technical specifications of a cable for a serial RS-232C-interface:

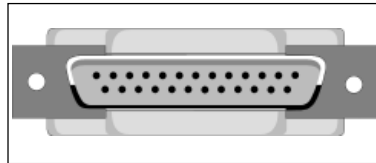25-pin plug: equivalent to DB25P
Plug housing: equivalent to DB-C2-J9.

Shielded Beldon cable or equivalent cable with a maximum length of 15 m. The cable should be a twisted-pair cable to prevent signal interference and must be UL- and CSA-certified. The printer has a 25-pin DB-25S-plug.

Interface Connection: On Printer

| Pin | Signal | Direction | Description | Pin Assignment |
|---|---|---|---|---|
| 1 | Protective Ground, PG | --- | Connected to printer's casing. | |
| 2 | Transmit Data,TD | from printer | Serial signal sent from the printer. | |
| 3 | Receive Data, RD | to printer | Serial signal received by the printer. | |
| 4 * | Ready to Send, RTS | from printer | Indicates that the printer is ready to receive data. | *You can set Pin 4, 11 or 20 as flow control line by selecting the menu option Busy Line. |
| 5 | Clear to Send, CTS | to printer | Indicates that system is ready to sent data to printer. | |
| 6 ** | Data Set Ready, DSR | to printer | Indicates that the system is ready. | ** You set the evaluation by selecting the menu option DSR Signal (Valid = Evaluate, Invalid = Ignore). |
| 7 | Signal Ground, SG | --- | Signal Ground. | |
| 8-10 | | | Not assigned. | |

| Pin | Signal | Direction | Description |
|---|---|---|---|
| 11 * | Flow Control, SSD | from printer | Indicates that the printer is not ready to receive data. |
| 12-17 | | | Not assigned. |
| 18 *** | +5 V | from printer | Voltage of + 5 Volt (max. 100 mA). |
| 19 | | | Not assigned. |
| 20 * | Data Terminal Ready DTR | from printer | Indicates that printer is ready to receive data. |
| 21-25 | | | Not assigned. |

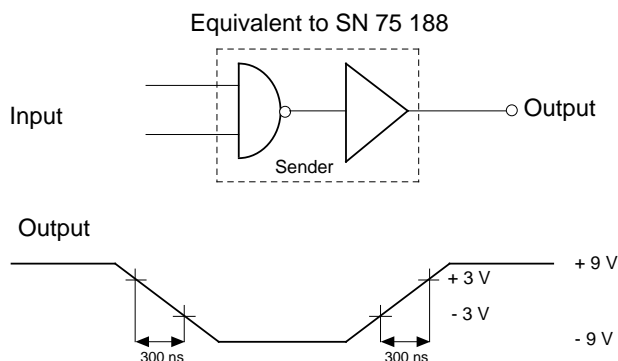*** *You may set Pin 18 to +5 V by selecting the menu option* **Pin 18***.*

**Signal levels**

MARK Polarity:  -3 to -15V:  LOW = OFF = Logical "1"
SPACE Polarity:  +3 to +15V:  HIGH = ON = Logical "0"

**Circuits**

### Input circuit

Equivalent to SN 75 154



### Output circuit

Equivalent to SN 75 188
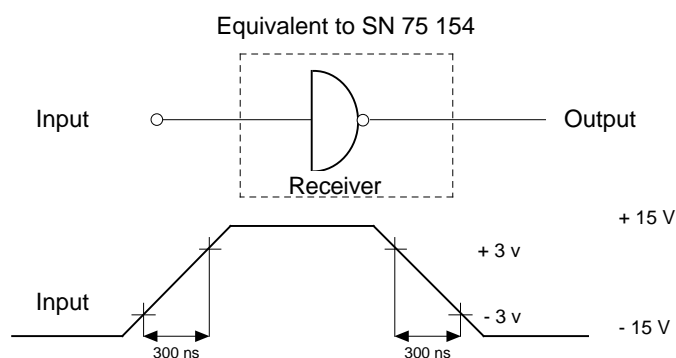
If you select the Ready/Busy protocol, the printer uses the voltage level on line RTS (4), SSD (11) or DTR (20) to inform the computer whether it is ready to receive data or whether its buffer is full. You can set the Busy line to one of above mentioned lines by selecting the option **Busy Line**. As soon as the printer is ready to receive data, the Busy-line DTR or RTS is set to high-level (Space). If you set the option **Busy Line** to **SSD-**, line SSD is also set to high-level (Space) as soon as the printer is ready to receive data. If you select **SSD+**, the line is set to low-level (Mark).

Ready/Busy Protocol

When you use the X-ON/X-OFF protocol the printer uses the line Transmit Data TD (2) and the command X-ON (DC1) to inform the computer that it is ready to receive data. The command X-OFF (DC3) is used to inform the computer that the printer buffer is full.

X-ON/X-OFF Protocol

## Interface Wiring

To indicate that the printer is ready to receive data, select **DTR**, **SSD+**, **SSD-** or **RTS** in the **Busy Line** menu.
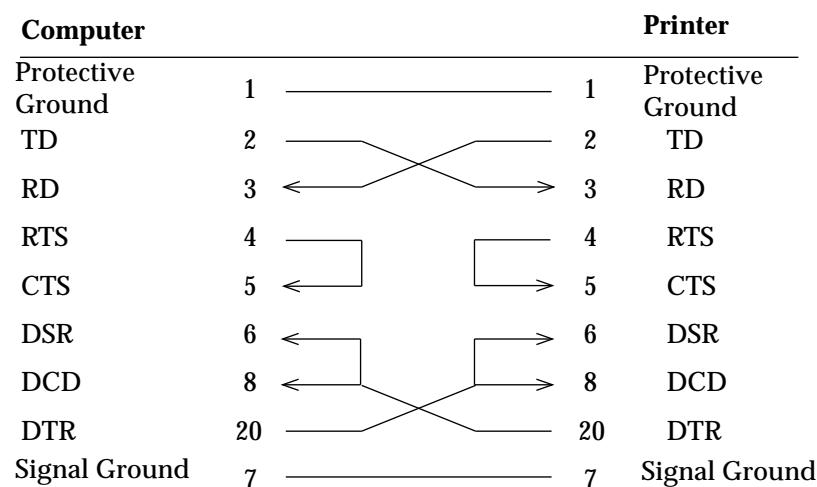
| Computer | | | | Printer |
|---|---|---|---|---|
| Protective Ground | 1 | ———————— | 1 | Protective Ground |
| TD | 2 | | 2 | TD |
| RD | 3 | | 3 | RD |
| RTS | 4 | | 4 | RTS |
| CTS | 5 | | 5 | CTS |
| DSR | 6 | | 6 | DSR |
| DCD | 8 | | 8 | DCD |
| DTR | 20 | | 20 | DTR |
| Signal Ground | 7 | ———————— | 7 | Signal Ground |

PC industry-standard 25-pin to 25-pin

*When using this circuit set the menu option Busy Line to DTR and Protocol to READY/BUSY. If you select the X-ON/X-OFF protocol, the setting for Busy Line is irrelevant. The value DSR in the printer menu must be set to Invalid.*

## AT industry-standard 9-pin to 25-pin

*When using this circuit set the menu option Busy Line to DTR and Protocol to READY/BUSY. If you select the X-ON/X-OFF protocol, the setting for Busy Line is irrelevant. The value DSR of the printer menu must be set to Invalid.*
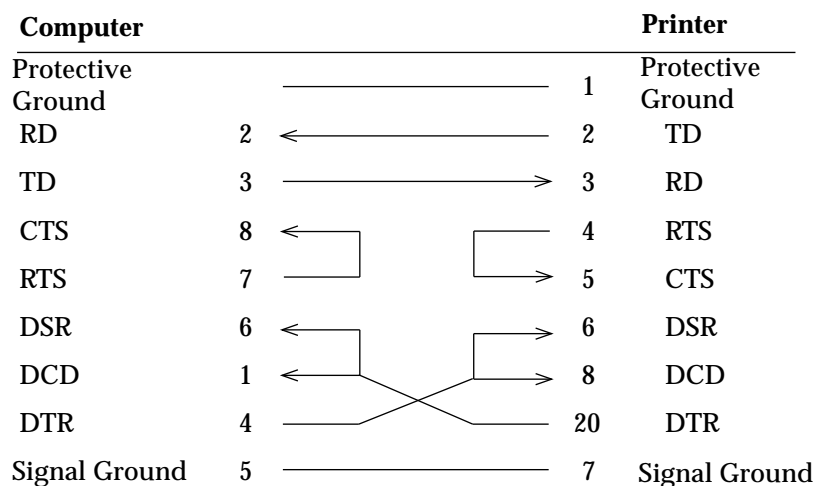
| **Computer** | | | **Printer** |
|---|---|---|---|
| Protective Ground | | 1 | Protective Ground |
| RD | 2 | 2 | TD |
| TD | 3 | 3 | RD |
| CTS | 8 | 4 | RTS |
| RTS | 7 | 5 | CTS |
| DSR | 6 | 6 | DSR |
| DCD | 1 | 8 | DCD |
| DTR | 4 | 20 | DTR |
| Signal Ground | 5 | 7 | Signal Ground |

It is not possible to give a definitive statement about the connections on computer side. If problems occur using the X-ON/X-OFF protocol, refer to the circuit below. Please note that it is assumed that signal DTR is set to SPACE on the computer.

## PC industry-standard 25-pin to 25-pin

*Ensure that the printer menu option DSR is set to Invalid.*

| **Computer** | | | **Printer** |
|---|---|---|---|
| Protective Ground | 1 | 1 | Protective Ground |
| TD | 2 | 2 | TD |
| RD | 3 | 3 | RD |
| RTS | 4 | 4 | RTS |
| CTS | 5 | 5 | CTS |
| DSR | 6 | 6 | DSR |
| DCD | 8 | 8 | DCD |
| DTR | 20 | 20 | DTR |
| Signal Ground | 7 | 7 | Signal Ground |

| Computer | | | Printer | |
|---|---|---|---|---|
| Protective Ground | | 1 | Protective Ground | |
| RD | 2 | ← 2 | TD | |
| TD | 3 | → 3 | RD | |
| CTS | 8 | ← 4 | RTS | |
| RTS | 7 | 5 | CTS | |
| DSR | 6 | ← 6 | DSR | |
| DCD | 1 | ← 8 | DCD | |
| DTR | 4 | 20 | DTR | |
| Signal Ground | 5 | 7 | Signal Ground | |

**AT industry-standard 9-pin to 25-pin**

*Ensure that the printer menu option DSR is set to Invalid.*
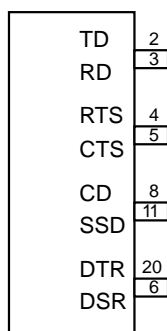
## Interface test

If the menu option **Diagnostic Test** is set to **Yes** and the test plug described below is connected to the serial interface, a test of the serial interface is automatically carried out when the printer is turned on. The result of the test will be printed.

This process is repeated until the printer is switched off. The printer will return to normal operation, when you set the menu option **Diagnostic Test** to **No**.

If you want to set the printer to menu mode while **Diagnostic Test** is set to **Yes**, hold the *MENU* key down while switching the printer on.

1 Canon DB-25S or equivalent plug

Canon DB-25S oder entsprechender Stecker

| | |
|---|---|
| TD | 2 |
| RD | 3 |
| RTS | 4 |
| CTS | 5 |
| CD | 8 |
| SSD | 11 |
| DTR | 20 |
| DSR | 6 |

(RS-232C)

# RS-422A Serial Interface

The RS-422A interface is often used when data is transmitted over long distances (max. 1.2 km). The type of data transmission is the same as used by the RS-232C interface, but the pin assignment and the signal levels are different. The transmission parameters of the RS-422A interface (configuration) on the printer side must therefore correspond to the system's parameters in this case as well.

*Interface boards may vary in design.*
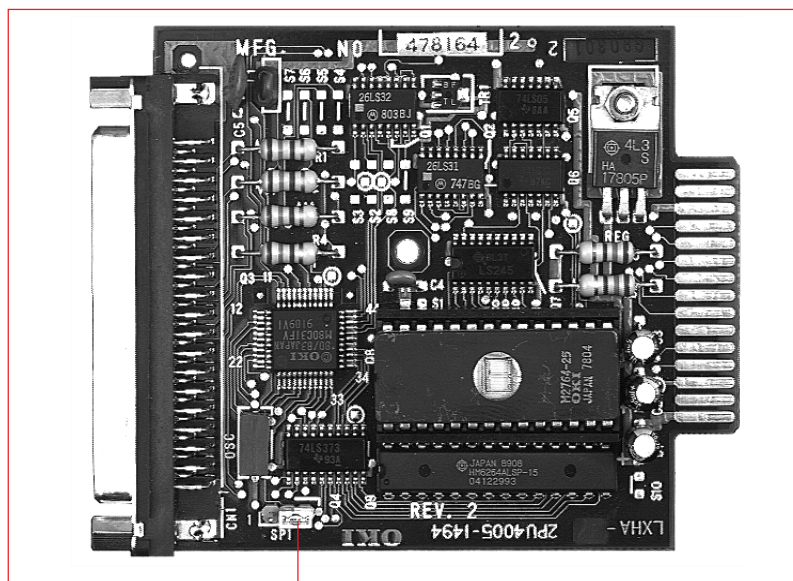


Test loop plug  SP1

The position of jumper plug SP1 should never be changed. If the interface's control program is stored in the microprocessor, SP1 has to connect the two pins close to the interface connection (Position 1). If the control program is stored in the EPROM, SP1 has to connect the two pins pointing away from the connection (see figure).
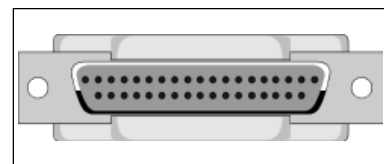
The interface cable has to meet the following requirements:

37-pin plug: equivalent to DC-37P
Plug housing: equivalent DC-C1-J16.

*Interface connection on printer side*

Shielded twisted-pair data transmission cable IBM Type 1. UL- and CSA-certified. The printer has a 37-pin DC-37S connector.

| Pin | Signal | Direction | Description | Pin assignment |
|---|---|---|---|---|
| 1 | Protective Ground, FG | --- | Connected to the printer's casing | |
| 3 * | Flow Control, SSD+ | from printer | With the Ready/ Busy protocol this signal indicates that | |
| 21 | Flow Control, SSD- | from printer | the printer is ready. | |
| 4 | Send Data, SD+ | from printer | | |
| 22 | Send Data, SD- | from printer | Data sent from printer. | |
| 6 | Receive Data, RD+ | to printer | | |
| 24 | Receive Data, RD- | to printer | Data sent to printer. | |
| 7 * | Ready to Send, RS+ | from printer | With the Ready/ Busy protocol this signal indicates that | * In the printer menu you can select Pin 3 and 21 (SSD), 7 and 25 (RS) or 12 and 30 (TR) as Busy line. |
| 25 | Ready to Send, RS- | from printer | the printer is ready. | |
| 9 | Clear to Send, CS+ | to printer | Data transmission starts when printer confirms | |
| 27 | Clear to Send, CS- | to printer | the signal as "Space". | |
| 11 ** | Ready to Send, DM+ | to printer | Indicates that data can be sent. The data is received as soon as the printer confirms | ** Use the menu option DSR Signal to select whether the signal DM is evaluated (option valid) or ignored (option invalid) by the printer. |
| 29 | Ready to Send, DM- | from printer | this signal as "Space". | |
| 12 * | Terminal Ready, TR+ | from printer | With the Ready/Busy prototcol this signal indicates whether the printer is ready to | |
| 30 | Terminal Ready, TR- | from printer | receive data. | |
| 2, 5, 8, 10, 13 to 18, 20, 23, 26, 28 31 to 37 | | | Not assigned. | |
| 19 | Signal Ground, SG | --- | Signal Ground | |

The signal levels described below are equivalent to the EIA-Standard RS-422A.

## Signal levels

MARK Polarity: -0,2 to -6,0V:   LOW = OFF = Logical "1"
SPACE Polarity: +0,2 to +6,0V:  HIGH = ON = Logical "0"

## Circuits

*The above mentioned values are based on a voltage of +5 V.*

**Input Circuit**        equivalent to Am 26LS32

Input

Input

Output

Differentiating Input (V)

+ 6 V

+ 200 mV

V

- 200 mV

- 6 V

Threshold Level

**Output Circuit**        equivalent to Am 26LS31

Input

Output +

V

Output -

3,2 V

V

Output -

0,32 V

0 V

3,2 V

Output +

V

0,32 V

0 V

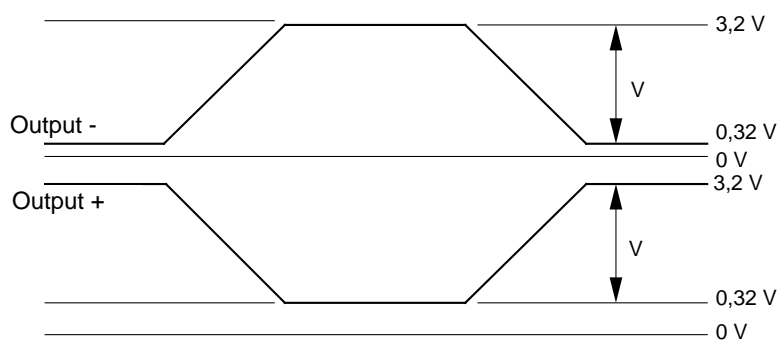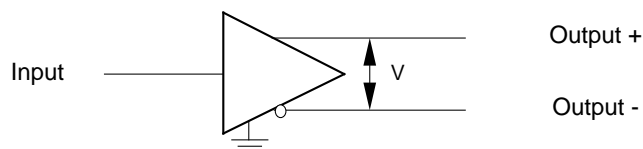| Option | Action |
|---|---|
| Parity | Is odd or even parity used?<br>odd parity > select **Odd**.<br>even parity > select **Even**.<br>no parity > select **None**. |
| Serial Data 7 or 8 Bits | Is the data format used 7 bit or 8 bit?<br>7-bit format > select **7 Bits**.<br>8-bit format > select **8 Bits**. |
| Protocol | Which protocol is used?<br>Ready/Busy Protocol > select **Ready/Busy**.<br>X-ON/X-OFF Protocol > select **X-ON/X-OFF**. |
| Diagnostic Test | Do you want to perform an I/F test?<br>Yes > select **Yes**.<br>Normal printing > select **No**. |
| Busy Line | Via which line is a Busy signal received?<br>SSD -9 V > select **SSD**-.<br>SSD +9 V > select **SSD+**.<br>DTR -9 V > select **DTR**.<br>RTS -9 V > select **RTS**. |
| Baud Rate | Which baud rate (Bit/s, BPS) is used?<br>19.2000 Baud > select **19200 BPS**.<br>9.600 Baud > select **9600 BPS**.<br>4.800 Baud > select **4800 BPS**.<br>2.400 Baud > select **2400 BPS**.<br>1.200 Baud > select **1200 BPS**.<br>600 Baud > select **600 BPS**.<br>300 Baud > select **300 BPS**. |
| DSR Signal | Does your system send a DSR signal to the printer?<br>Yes > select **Valid**.<br>No > select **Invalid**. |
| DTR Signal | When is a DTR signal sent?<br>When turning the printer ON-LINE ><br>select **Ready on Select**.<br>When turning the printer on ><br>select **Ready on Power Up**. |
| Busy Time | Which pulse duration is required for a Busy-signal?<br>200 ms > select **200 ms**.<br>1 second > select **1 s**. |

Menu options for the serial interfaces (RS-232C, RS-422A)

When using a serial interface, set the menu options in above table as required by your systems interface.

After selection of the desired options it is recommended to print the menu.

# Transmission Protocols

You can select the two protocols for the serial transmission (interface RS-232C and RS-422A) in the print menu as explained below.

Ready/Busy

The signal Busy is enabled (Busy), when less than 256 bytes are available in the interface buffer. The signal is disabled (Ready) after 200 ms or 1 second if sufficient buffer capacity has been freed within this period of time. If printing the buffer takes longer than 200 ms or 1 second the signal is disabled (Ready), as soon as sufficient capacity is available.

X-ON/X-OFF

This protocol uses the ASCII characters DC3 (decimal 19) and DC1 (decimal 17) for the control of data transmission. As soon as there are less than 256 bytes available in the buffer, the code DC3 informs the sender that no more data can be received. The code DC3 is transmitted until no more data is transmitted. If it is possible to print the buffer within 200 ms or 1 second after having sent a DC3 signal, a DC1 signal displays 200 ms or 1 second after sufficient capacity has been freed that the printer is ready to receive data. If it takes longer than 200 ms or 1 second to release the buffer, the code DC1 is sent as soon as sufficient capacity is available.

For both protocols the time period of 200 ms or 1 second can be selected in the menu option **Busy Time**.

# Connections of the RS-422A Interface

In the RS-422A interface, the incoming and outgoing signals are connected to the ports via differential circuits. Therefore two lines are required for each signal to be transmitted. The inverted signals are identified with "+" and the non-inverted signals are identified with "-".

Four lines are required for this connection, two for the data sent to the printer and two for the status message sent from the printer to the computer. The polarity of the two lines required for each signal

is particularly important. A connection with the signal ground between host and printer is not required.

As it is not possible to list all the different RS-422A- interface boards with the different pin assignments and port identifications ("+" and "-" for inverted signals or vice versa), only example circuits with inverted polarity are listed below. The required configuration of the computer is explained in detail. If SSD is used as Ready/Busy line the polarity of the ports "+" and "-" can be selected in the printer menu, where SSD+ is the polarity of the ports TR and RS (see diagram 2). If the ports SSD+ and SSD- are reversed, you have to select the option SSD-. If the printer prints data which is in no way similar to the data sent by the host, the polarity of the ports RD+ and RD- may be reversed.

The wiring of the dual serial interface board HP 24541B with the RS-422A interface of the printer is described as a circuit example. With this interface board the mode RS-232C or RS-422A can be used. For further information about the configuration of this board see the manual of the board.

**Diagram 1**                                                                              Diagrams

Protocol: Ready/Busy
Ready/Busy-Line (printer): TR

| Host | Printer | Menu Settings |
|------|---------|---------------|



| | | Serial I/F Option | Protocol | Ready/Busy |
|---|---|---|---|---|
| SD+ | SSD+ 3 | | Busy Line | DTR |
| SD- | SSD- 21 | | DSR Signal | Invalid |
| RD+ | SD+ 4 | | | |
| RD- | SD- 22 | | | |
| RS+ | RD+ 6 | | | |
| RS- | RD- 24 | | | |
| CS+ | RS+ 7 | | | |
| CS- | RS- 25 | | | |
| GND | CS+ 9 | | | |
| | CS- 27 | | | |
| | DM+ 11 | | | |
| | DM- 29 | | | |
| | TR+ 12 | | | |
| | TR- 30 | | | |
| | GND 19 | | | |
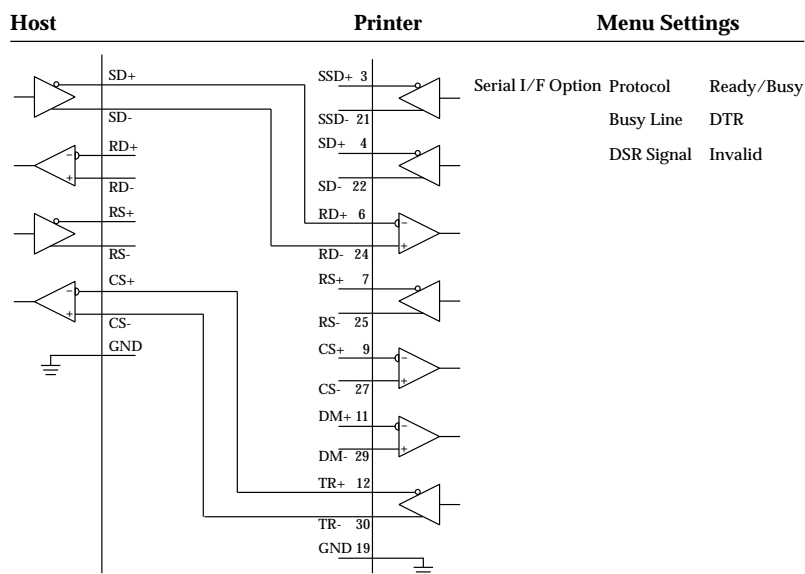
## Diagram 2

Protocol: Ready/Busy
Ready/Busy-Line (printer): SSD+

| Host | Printer | Menu Settings |
|------|---------|---------------|



| | | | |
|---|---|---|---|
| | Serial I/F Option | Protocol | Ready/Busy |
| | | Busy Line | SSD+ |
| | | DSR Signal | Invalid |
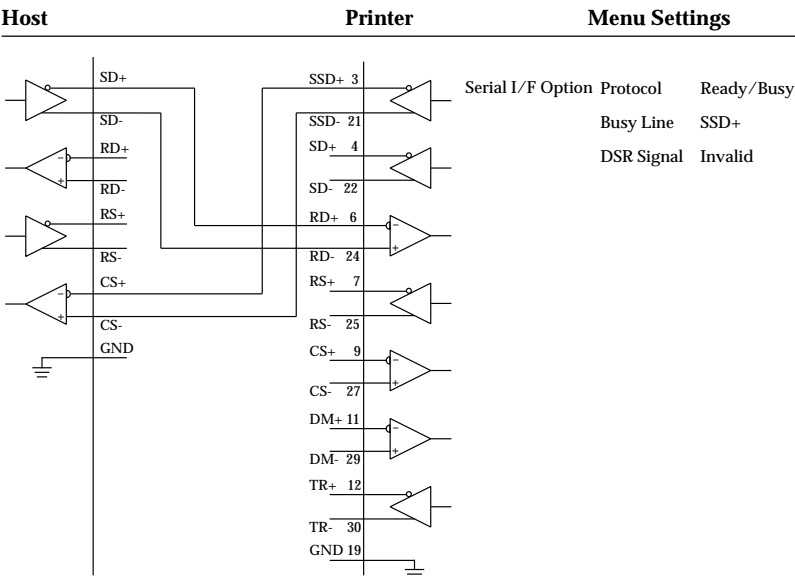
## Diagram 3

Protocol: Ready/Busy
Ready/Busy-Line (printer): SSD-

| Host | Printer | Menu Settings |
|------|---------|---------------|



| | | | |
|---|---|---|---|
| | Serial I/F Option | Protocol | Ready/Busy |
| | | Busy Line | SSD- |
| | | DSR Signal | Invalid |
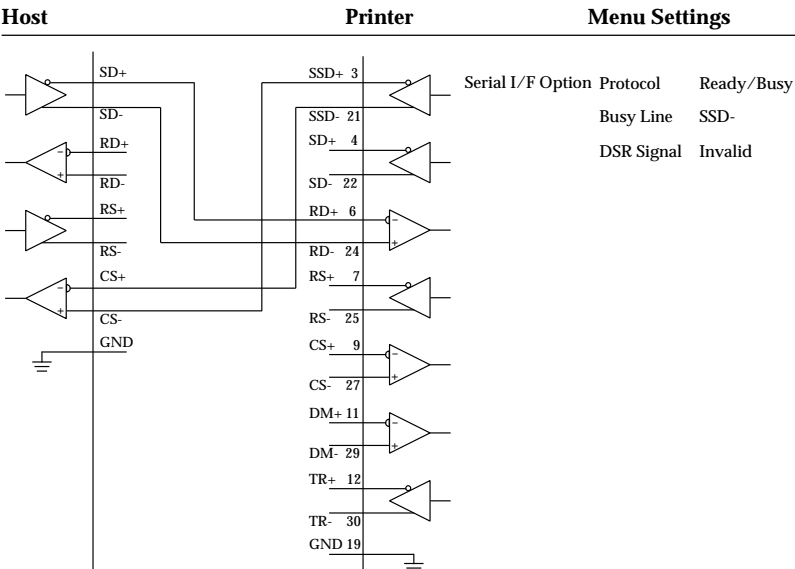
**Diagram 4**

Protocol: Ready/Busy
Ready/Busy-Line (printer): RS

| Host | Printer | Menu Settings | |
|---|---|---|---|
| | | Serial I/F Option Protocol | Ready/Busy |
| | | Busy Line | RTS |
| | | DSR Signal | Invalid |

SD+  SSD+ 3
SD-  SSD- 21
RD+  SD+ 4
RD-  SD- 22
RS+  RD+ 6
RS-  RD- 24
CS+  RS+ 7
CS-  RS- 25
GND  CS+ 9
     CS- 27
     DM+ 11
     DM- 29
     TR+ 12
     TR- 30
     GND 19
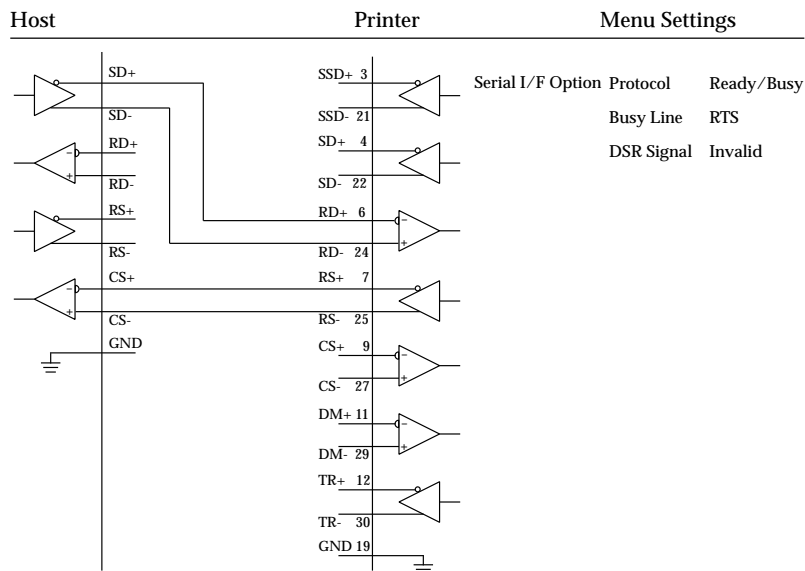
**Diagram 5**

Protocol: X-ON/X-OFF
Printer status line: SD

| Host | Printer | Menu Settings | |
|---|---|---|---|
| | | Serial I/F Option Protocol | X-ON/X-OFF |
| | | Busy Line | – |
| | | DSR Signal | Invalid |

SD+  SSD+ 3
SD-  SSD- 21
RD+  SD+ 4
RD-  SD- 22
RS+  RD+ 6
RS-  RD- 24
CS+  RS+ 7
CS-  RS- 25
GND  CS+ 9
     CS- 27
     DM+ 11
     DM- 29
     TR+ 12
     TR- 30
     GND 19
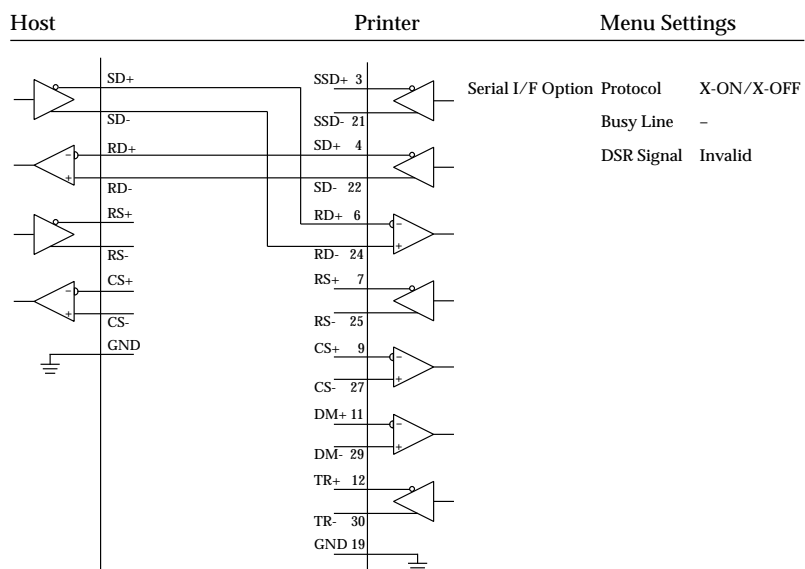
Examples

**Diagram 6**

Protocol: Ready/Busy
Ready/Busy-Line (printer): SD

HP 24541B                                  Printer                              Menu Settings

| HP 24541B | Printer | | |
|---|---|---|---|
| SD.A  9 | SSD+  3 | Serial I/F Option Protocol | Ready/Busy |
| SD.B  10 | SSD-  21 | Busy Line | DTR |
| CB (CTS)  5 | SD+  4 | DSR Signal | Invalid |
| CC (DSR)  6 | SD-  22 | | |
| RD.B  18 | RD+  6 | | |
| | RD-  24 | | |
| | RS+  7 | | |
| | RS-  25 | | |
| | CS+  9 | | |
| | CS-  27 | | |
| | DM+  11 | | |
| | DM-  29 | | |
| | TR+  12 | | |
| | TR-  30 | | |
| | GND 19 | | |
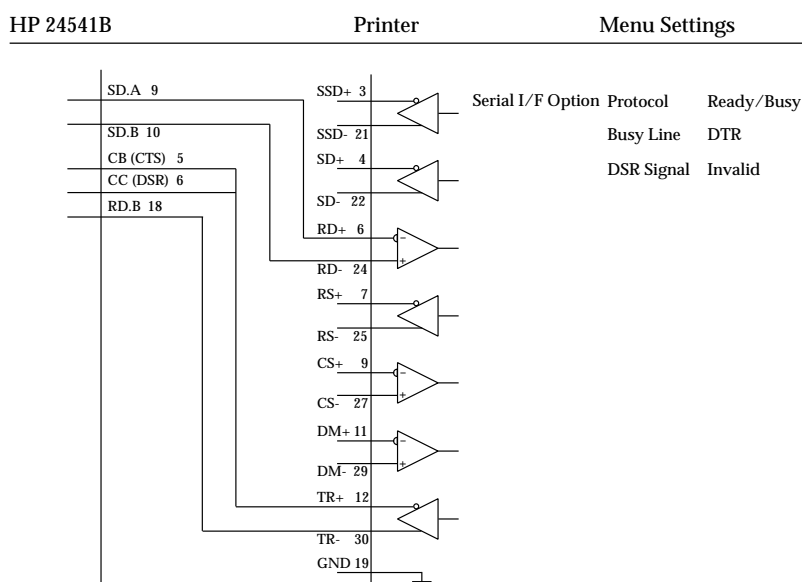
In this circuit (connection of a HP 24541B interface board with RS-422A-interface of the printer) the ports SD.A, Pin 9 and SD.B, Pin 10 are connected to the ports RD+, Pin 6 and RD-, Pin 24 of the printer interface. These are the two lines for the transmission of the print data.

The two lines for the Ready/Busy-Signal are created by connecting ports CB (CTS), Pin 5 and RD.B, Pin 18 to the ports TR+, Pin 12 and TR-, Pin 30 of the printer interface. Additionally a connection to CC (DSR), Pin 6, is established on the host side from CB (CTS), Pin 5.
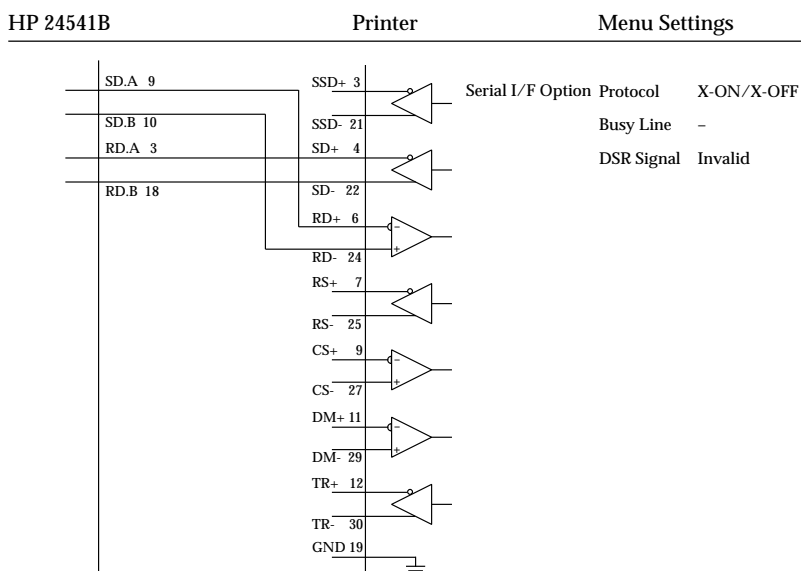
Looking at the two Ready/Busy-lines please note the following: although the port RD.B, Pin 18 on the host side is specific for the RS-422A interface, the second line is connected to the ports CB (CTS), Pin 5 and CC (DSR), Pin 6 of the RS-232C interface. This ensures the correct transmission of data with many applications, but it cannot be guaranteed for all applications.

When printer and software status signals X-ON and X-OFF are evaluated by an application while this circuit example is used, the correct data transmission with this type of interface board on the host side is not possible.

**Diagram 7**

Protocol: X-ON/X-OFF
Printer status line: TD

| HP 24541B | Printer | Menu Settings |
|---|---|---|

```
SD.A  9          SSD+  3          Serial I/F Option   Protocol      X-ON/X-OFF
SD.B  10         SSD-  21                             Busy Line     –
RD.A  3          SD+   4                               DSR Signal    Invalid
                 SD-   22
RD.B  18         RD+   6
                 RD-   24
                 RS+   7
                 RS-   25
                 CS+   9
                 CS-   27
                 DM+   11
                 DM-   29
                 TR+   12
                 TR-   30
                 GND   19
```

In this circuit example (connecting a HP 24541B interface board with the RS-422A interface of the printer) the ports SD-A, Pin 9, and SD.B, Pin 10 are connected to ports RD+, Pin 6 and RD-, Pin 24 of the printer interface, as shown in example 6. In this circuit example (HP 24541B interface board connected to the RS-422A interface of the printer) the ports SD.A, Pin 9 and SD.B, Pin 10 are connected to the ports RD+, Pin 6 and RD-, Pin 24 of the printer interface. These are the two transmission lines for the print data.

The two lines for the printer status are established by connecting the ports RD.A, Pin 3 and RD.B, Pin 18 with the ports of the printer interface TR+, Pin 12 and TR-, Pin 30.

Please note the Ready/Busy-lines in this circuit: although port RD.B, Pin 18 on host side is specific for the RS-422A interface, the second line is connected to port RD.A, Pin 3 of the RS-232C interface. This ensures correct transmission of data with most applications, but it cannot be guaranteed for all applications.

If an application is confused by the fact that the software printer signals X-ON and X-Off are also sent to port RD.B, Pin 18 with dual function for software and hardware signals, the correct transmission of data with this interface board on host side is not possible.
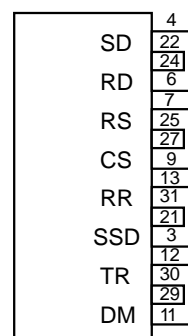
# Interface Test

You can start a self test of the serial interface by using a test loop plug. The following plug is required for an interface test of the RS-422A interface:

If the menu option **Diagnostic Test** is set to **Yes** and the test loop plug is connected to the serial interface, a self test is carried out automatically. The result of the test will be printed.

This process is repeated until the printer is turned off. The printer will return to normal printing operation and is ready to receive data, when the menu option **Diagnostic Test** is set to **No**.

To set the printer to menu mode while **Diagnostic Test** is set to **Yes**, hold the *MENU* key down while switching the printer on.

Canon DC-37P or equivalent plug

| | |
|---|---|
| SD | 4 |
| | 22 |
| | 24 |
| RD | 6 |
| | 7 |
| RS | 25 |
| | 27 |
| CS | 9 |
| | 13 |
| RR | 31 |
| | 21 |
| SSD | 3 |
| | 12 |
| TR | 30 |
| | 29 |
| DM | 11 |

(RS-422A)

# Coresident RS-232C / Current Loop Interface

The arrangement of a short-circuit jumper on the printed circuit board determines whether this interface board is used as RS-232C or Current Loop interface. Both modes allow for three transmission protocols. The protocols are determined by the arrangement of jumpers or can be selected in the printer menu.
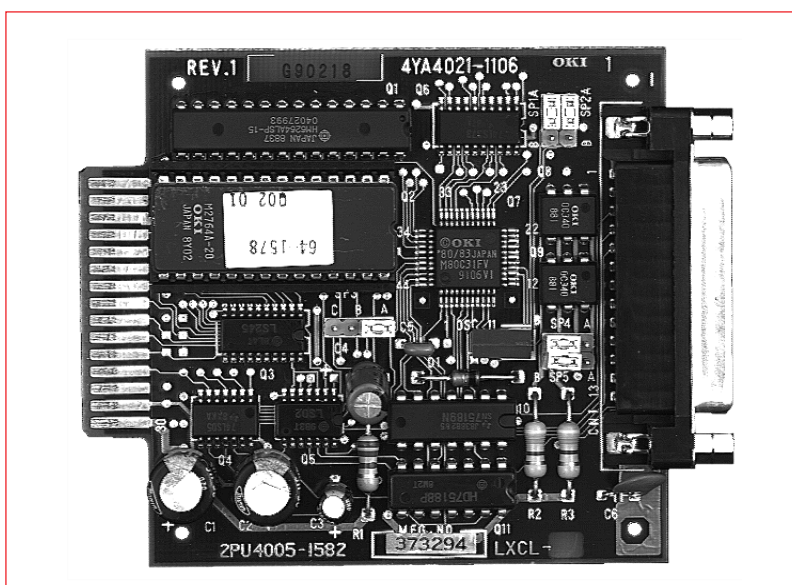


*Interface boards may vary in design.*

The following pages contain information about the correct jumper assignment and the correct menu selections for each mode as well as general technical details and information about transmission protocols.

Technical data

| Term | Description |
|------|-------------|
| Interface type | RS-232C/Current Loop coresident |
| Data transmission | Serial (Start/Stop Synchronisation) |
| Transmission rate (bit/s) | 110, 150, 300, 600, 1200, 2400, 4800, 9600 bit/s |
| Number of data bits | 7 or 8 Bits |
| Parity | Even, odd or no parity |

*The transmission format of 7 bits without parity is not valid*

| Term | Description | |
|---|---|---|
| Number of stop bits | one or more bits | |
| Transmission protocols | three protocols | |
| Interface connection | on printer side: | 25-pin plug, DB-25S or equivalent, |
| | on cable side: | 25-pin plug, DP-25P or equivalent |
| Interface signals | see table for interface signals | |

The interface signals, pin assignment and circuits of the RS-232C coresident interface are not mentioned again here, as they are like the simple RS-232C interface, described earlier in this chapter..

## Current Loop Interface

Interface signals

| Pin | Signal | Direction | Description |
|---|---|---|---|
| 1 | Protective Ground, PG | --- | connected to the printer's casing |
| 2 - 6 | --- | --- | not assigned |
| 7 | Signal Ground, SG | --- | Signal Ground |
| 8 | --- | --- | not assigned |
| 9 | Current Loop, D+ Receive loop | to printer | printer receive signal for serial data |
| 10 | Current Loop, D- Receive loop | to printer | return line for D+ signal |
| 11,12 | --- | --- | not assigned |
| 13 | Signal Ground, SG | --- | Signal Ground |
| 14 - 17 | --- | --- | not assigned |
| 18 | Current Loop, B+ Send loop | from printer | printer send signal for serial data * |
| 19 | Current Loop, B- Send loop | from printer | return line for D+ signal |
| 20-25 | --- | --- | not assigned |

\* The functions of the circuit B+ -> B-  differ depending on the protocol used. When selecting a protocol the functions are adjusted automatically:

● Ready/Busy Protocol: indicates that the printer is not ready to receive data. This type of protocol is also used for error detection.

● X-ON/X-OFF Protocol: serial data from printer (the printer only sends the codes DC1 and DC3).

● Centronics Blocked Duplex Protocol: serial data from printer (the printer only sends the codes ACK and NAK).

The selection of different interface modes, the transmission protocol and the number of lines used for the transmission is determined by the arrangement of the five jumpers SP1 to SP5, as shown in the table below, and by the menu settings of the printer.

You select the different modes by appropriately setting short-circuit jumper SP2. The menu setting of the printer determines whether the Ready/Busy protocol or X-ON or X-OFF protocol is used.

Interface selection

The **Centronics Blocked Duplex** transmission protocol can only be selected by appropriately setting short-circuit jumper SP1. The functions of the short-circuit jumpers and the menu settings are listed in the following table.

**Functions of short-circuit jumper and protocol selection in printer menu**

| Interface | Protocol | Power Source | Number of Lines | SP1 | SP2 | SP3 | SP4 | SP5 | Menu Settings |
|---|---|---|---|---|---|---|---|---|---|
| RS-232C | Ready/Busy | _ | _ | A | A | A | A/B | A/B | Ready/Busy |
| RS-232C | X-ON/X-OFF | _ | _ | A | A | A | A/B | A/B | X-ON/X-OFF |
| RS-232C | CBD * | _ | _ | B | A | A | A/B | A/B | ** |
| Current Loop | Ready/Busy | passive | 2 | A | B | B | A | A | Ready/Busy |
| Current Loop | Ready/Busy | passive | 4 | A | B | C | A | A | Ready/Busy |
| Current Loop | Ready/Busy | active | 2 | A | B | B | B | A | Ready/Busy |
| Current Loop | Ready/Busy | active | 3 | A | B | C | B | B | Ready/Busy |
| Current Loop | X-ON/X-OFF | passive | 2 | A | B | B | A | A | X-ON/X-OFF |
| Current Loop | X-ON/X-OFF | passive | 4 | A | B | C | A | A | X-ON/X-OFF |
| Current Loop | X-ON/X-OFF | active | 2 | A | B | B | B | A | X-ON/X-OFF |
| Current Loop | X-ON/X-OFF | active | 3 | A | B | C | B | B | X-ON/X-OFF |

| Interface | Protocol | Power Source | Number of Lines | SP1 | SP2 | SP3 | SP4 | SP5 | Menu Settings |
|---|---|---|---|---|---|---|---|---|---|
| Current Loop | CBD * | passive | 2 | B | B | B | A | A | ** |
| Current Loop | CBD * | passive | 4 | B | B | C | A | A | ** |
| Current Loop | CBD * | active | 2 | B | B | B | B | A | ** |
| Current Loop | CBD * | active | 3 | B | B | C | B | B | ** |

\*      CBD = Centronics Blocked Duplex

\**      Protocol setting in menu will not be applied.

Rearrange the jumpers only when the printer is turned off.

Component layout diagram

The component layout diagram of the printed circuit board for the coresident serial RS-232C/Current Loop interface and the arrangement of the jumpers (SP1 - SP5) is shown in the following figures.
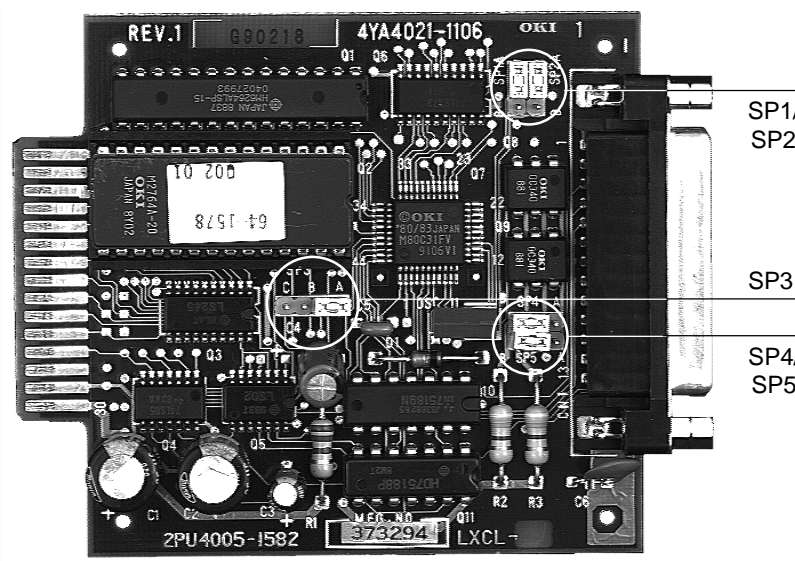




SP 3: Port Assignment
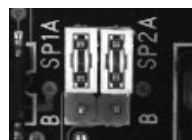


SP1: Protocol Selection

SP2: RS-232C/Current Loop



SP4: Power Source Receive Loop

SP5: Power Source Send Loop

# Transmission Protocols

The following pages explain the transmission procedures of the three different types of protocol.

If the printer is unable to receive data, the current loop for signal B + opens when the 50 μs following the stop bit of the last character is received.

Ready/Busy Protocol

**Timing Diagram**
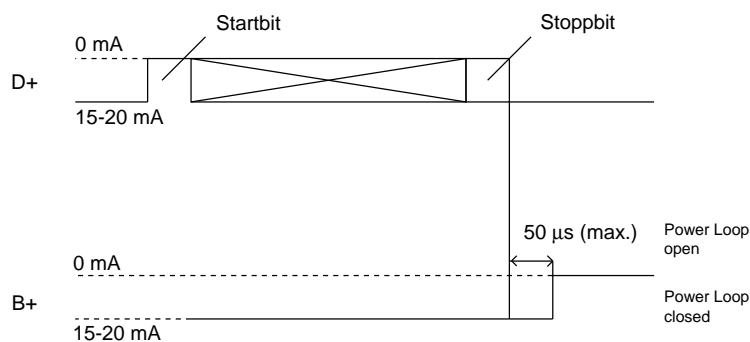


Block format: any

Error Message: a parity error is displayed as @ (4OH).

Display of Busy Status: the minimum interval during which the printer is unable to receive data is selected in the **Busy Time** menu. The interval for the Busy signal can be set to either 200 ms or 1 second.

The printer is not ready to receive data if the capacity of the interface buffer drops below 521 bytes. The printer is ready to receive data again when 512 bytes are free in the printer buffer after 200 ms or 1 s have elapsed. If the memory threshold of 512 bytes is not reached during the busy status of 200 ms or 1 s, the printer only signals its ability to receive data when more than 512 bytes of memory are available.

X-ON / X-OFF Protocol

**Timing diagram**
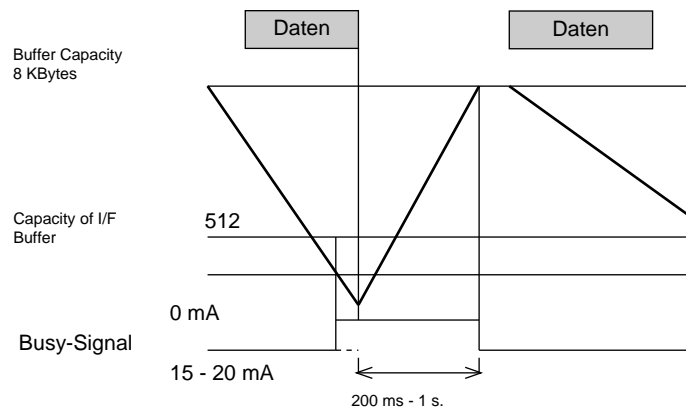


Block format: unblocked

Error message: a parity error is displayed as @ (40H).

Display of Busy Status: as soon as the capacity of the interface buffer drops below 512 Byte, the printer sends a DC3 signal to the sender indicating that no data can be received. The signal DC3 is only sent as long as data is sent to the printer (see note).

If after 200 ms or 1 s, 512 bytes or more memory is available, the printer sends the signal DC1 to the sender indicating that it is ready to receive data. The signal DC1 is only sent as soon as 512 Byte or more memory is available. (Select the setting 200 ms or 1 s in the Busy Time menu.)

**Timing diagram**
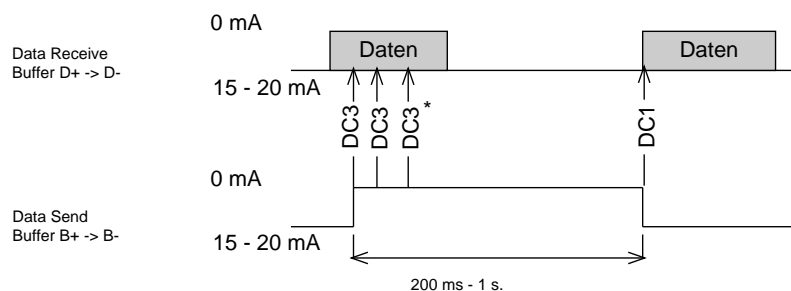


*   If data is sent while the printer is unable to receive data, the code DC3 is sent every time data arrives at the printer.

Block format: STX + Data + ETX

Data outside a block is ignored.

Error Detection:

**A block was transmitted correctly**: after having received an ETX signal an ACK signal is transmitted to the sender confirming that the data was received without any errors.
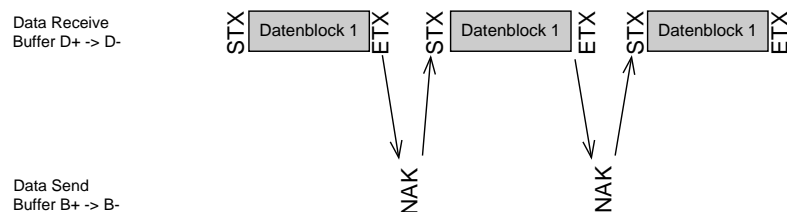
**A block was transmitted incorrectly:** after having received an ETX signal a NAK signal is transmitted to the sender indicating that an error occurred during the transmission. On receipt of the NAK signal the block has to be transmitted again.

Display of Busy Status: None

**If no error was detected:**
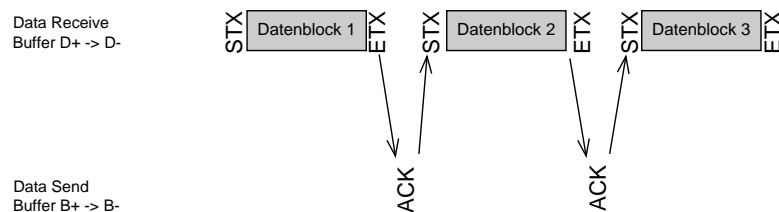


**If an error was detected:**



Data for Bitmap Graphics

The above mentioned timing diagrams are only valid as long as the printer is in text mode. The start character STX and the stop character ETX are only interpreted as control characters of the CBD transmission protocol in text mode. Please note the following if you want to print bitmap graphics:

The graphic data of a print line have to be sent to the printer within a block of text. This block of text has to start with the characters STXand has to finish with the characters ETX.

Centronics Blocked
Duplex (CBD) Protocol

Maximum length of block: 0 to 1 KByte (8 KByte)

The maximum length of a block of data equals the capacity of the interface's printer buffer. This capacity should never exceed 1 KByte.

If a parity error occurs or if the buffer overflows during the transmission, the block causing the error is ignored, a NAK signal is sent and the block is requested again.

## Connections of the Current Loop Interface

Please note that closed loops are created when using a current loop interface in order to connect the sender (host) to the receiver (printer).

Connections with one or more current loops can also be produced. If only one current loop is used, only the blocked Centronics Blokked Duplex transmission protocol can be used. When using only one circuit, the receiving and sending circuit of the host and printer must be connected in seies. It is therefore not possible to receive print data and send status messages simultaneously. Each current loop has to contain a power source which can be made available by either the host or the printer. Several power sources are not allowed within one loop.
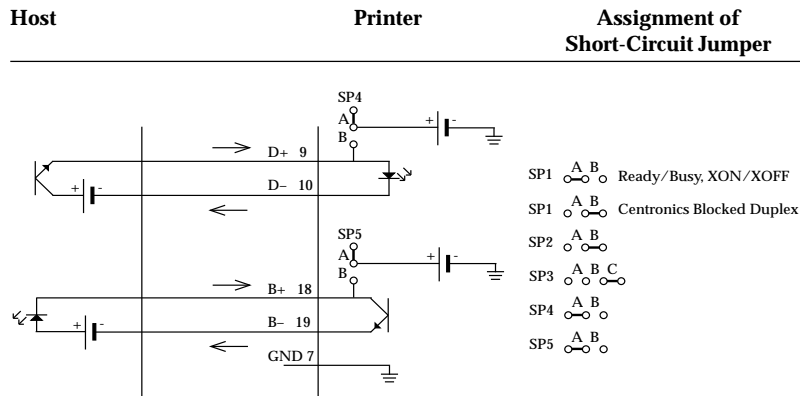
Only example circuits are listed below as it is not possible to show the numerous Current Loop interfaces with the different circuits. The required printer configuration is explained in detail.

As an example, the connection of the IBM Asynchronous Communication Adapter to the Current Loop interface of the printer is described. With this adapter the operating mode can be set to RS-232A interface or Current Loop interface. For further information about the configuration of this adapter see *IBM Personal Computer Technical Reference Manual, P/N 6936844,*.

**Diagram 1**                                                         Diagrams

Connection: 4-wire
Power source receive loop: Host
Power source send loop: Host

| **Host** | **Printer** | **Assignment of Short-Circuit Jumper** |
|---|---|---|



| | |
|---|---|
| SP1 A B | Ready/Busy, XON/XOFF |
| SP1 A B | Centronics Blocked Duplex |
| SP2 A B | |
| SP3 A B C | |
| SP4 A B | |
| SP5 A B | |

**Diagram 2**

Connection: 4-wire / (3-wire)
Power source receive loop: Printer
Power source send loop: Printer

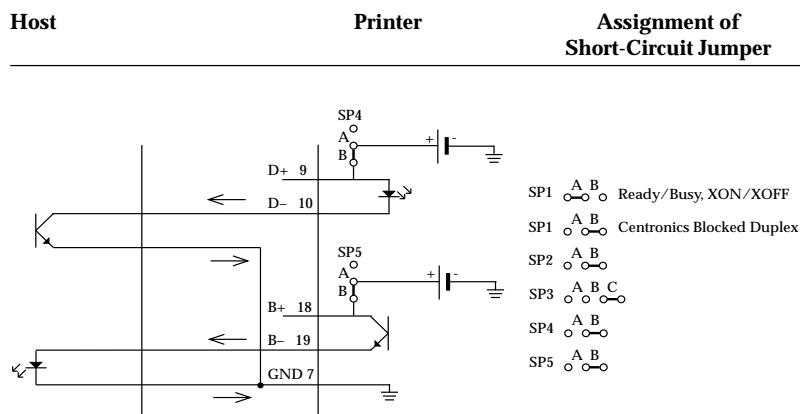| **Host** | **Printer** | **Assignment of Short-Circuit Jumper** |
|---|---|---|



| | |
|---|---|
| SP1 A B | Ready/Busy, XON/XOFF |
| SP1 A B | Centronics Blocked Duplex |
| SP2 A B | |
| SP3 A B C | |
| SP4 A B | |
| SP5 A B | |

## Diagram 3

Connection: 4-wire
Power source receive loop: Host
Power source send loop: Printer

| Host | Printer | Assignment of Short-Circuit Jumper |
|---|---|---|
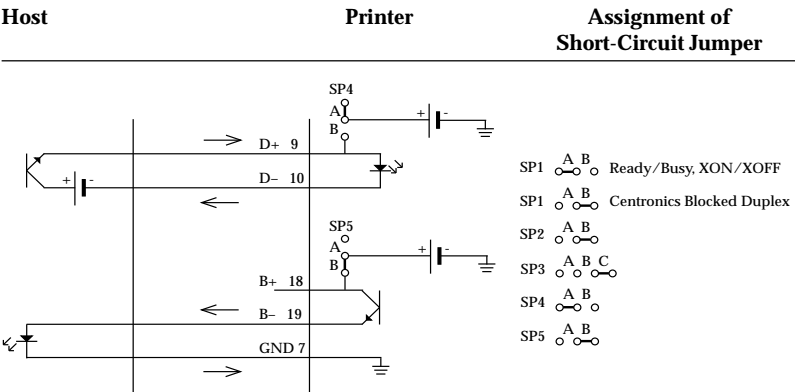


## Diagram 4

Connection: 4-wire
Power source receive loop: Printer
Power source send loop: Host

| Host | Printer | Assignment of - Short-Circuit Jumper |
|---|---|---|
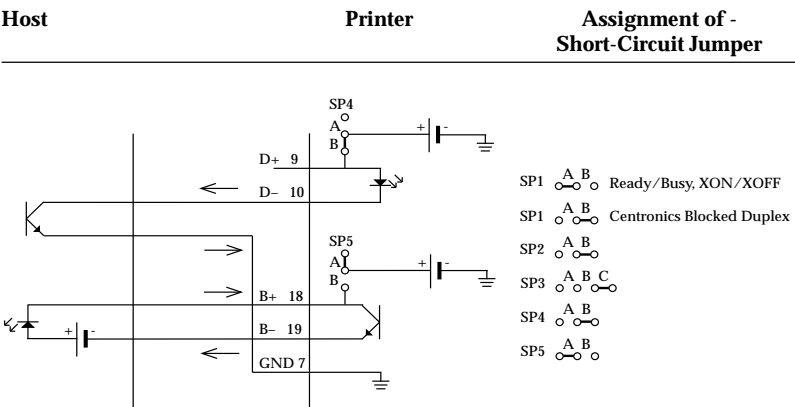
**Diagram 5**

Connection: 3-wire
Power source receive loop: Printer
Power source send loop: Printer

| Host | Printer | Assignment of Short-Circuit Jumper |
|---|---|---|

SP4
A
B
D+ 9
D− 10

SP1 A B  Ready/Busy, XON/XOFF
SP1 A B  Centronics Blocked Duplex
SP2 A B
SP3 A B C

SP5
A
B
B+ 18
B− 19
GND 7

SP4 A B
SP5 A B
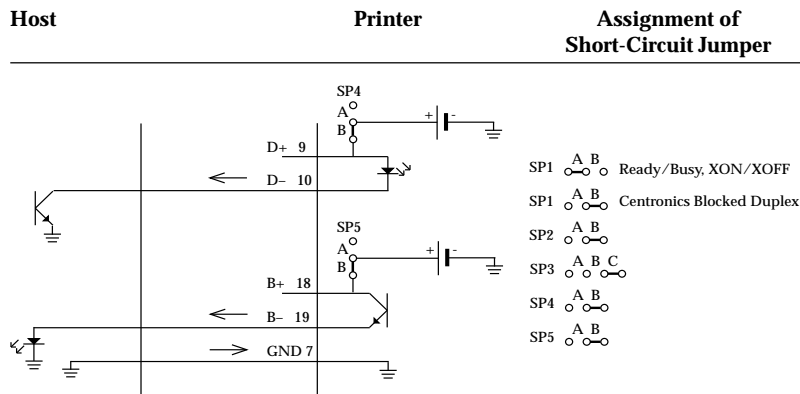
**Diagram 6**

Connection: 2-wire
Power source receive loop: none
Power source send loop: Host
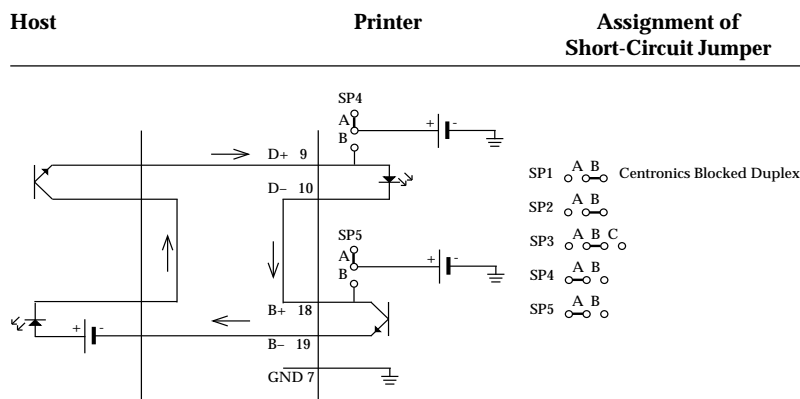
| Host | Printer | Assignment of Short-Circuit Jumper |
|---|---|---|

SP4
A
B
D+ 9
D− 10

SP1 A B  Centronics Blocked Duplex
SP2 A B

SP5
A
B
B+ 18
B− 19
GND 7

SP3 A B C
SP4 A B
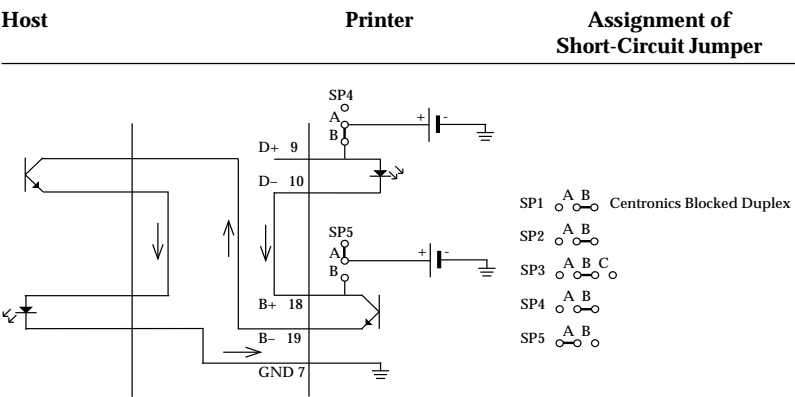SP5 A B

In combination with this circuit you can only use the Centronics Blocked Duplex protocol in order to ensure the correct transmission of data.

**Diagram 7**

Connection: 2-wire
Power source receive loop: Printer
Power source send loop: None

| **Host** | **Printer** | **Assignment of Short-Circuit Jumper** |
|---|---|---|



In combination with this circuit you can only use the Centronics Blocked Duplex protocol in order to ensure the correct transmission of data.

Technical note

One must differentiate between 2-wire-connections (see diagram 6 and 7) and circuits in which only the receive loop D+ -> D- of the printer is connected. Strictly speaking these are 4-wire circuits (see diagram 1 to 4), in which the send loop B+ -> B- of the printer is not integrated in the circuit. It is therefore not possible to control the printer status (Ready to Receive or Receive Buffer Full).

This circuit is often used by measuring systems and unit controls to which a log printer is connected. Received data is printed immediately without having to store it in the buffer. Even if a low transmission rate is used, no data is lost.

To ensure a constant power supply of 15 mA to 20 mA, the wire resistance as well as the number of electronic components in the current loop has to be considered. This means that the appropriate current control resistors of the power source used have to be adjusted to the prevailing electrical conditions on either the printer or the computer.

The above mentioned procedures should only be carried out by trained technicians referring to the technical documentation (circuit diagrams etc.) of the printer interface and the computer interface.

## Diagram 8

Connection: 2-wire
Power source receive loop: Printer
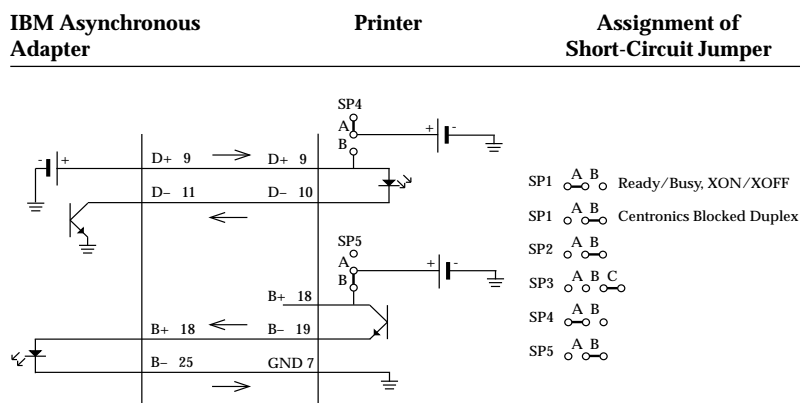Power source send loop: None

### Examples

*This connection is equivalent to circuit diagram 3.*



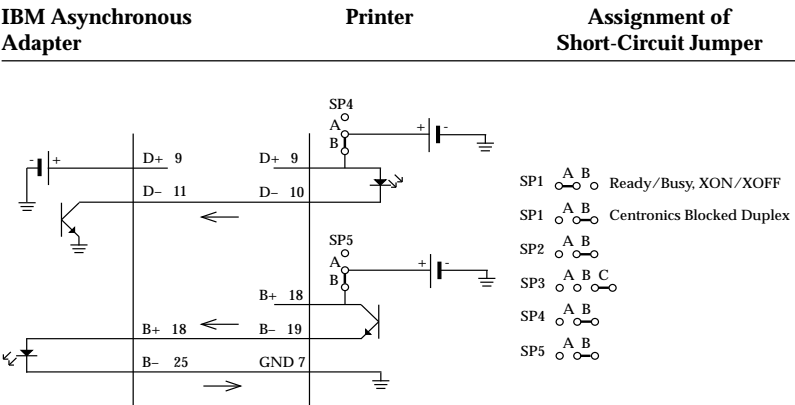| IBM Asynchronous Adapter | Printer | Assignment of Short-Circuit Jumper |
| --- | --- | --- |
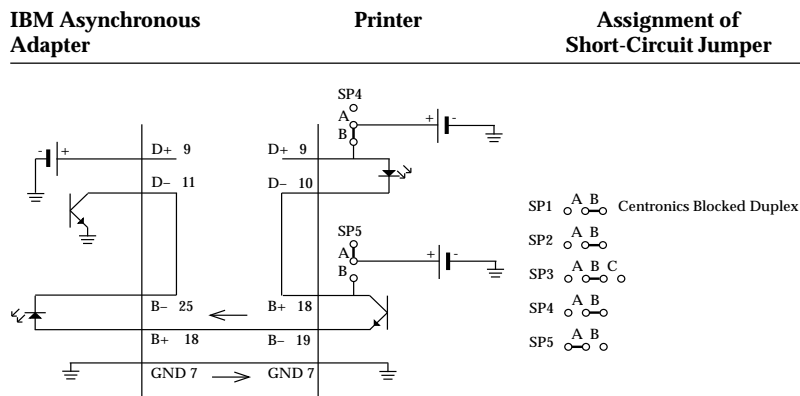
## Diagram 9

Connection: 4-wire
Power source receive loop: Host
Power source send loop: Printer

*This connection is equivalent to circuit diagram 5.*



| IBM Asynchronous Adapter | Printer | Assignment of Short-Circuit Jumper |
| --- | --- | --- |

**Diagram 10**

Connection: 3-wire
Power source receive loop: Printer
Power source send loop: Printer

| IBM Asynchronous Adapter | Printer | Assignment of Short-Circuit Jumper |
|---|---|---|



This connection is equivalent to circuit diagram 7. A circuit according to diagram 13 is not possible with the IBM Asynchronous Adapter, as the voltage supplied by this adapter's power source is not sufficient for the interfaces. Please refer to the section »Technical Note« earlier on in this chapter.

You can use the Centronics Blocked Duplex protocol only in combination with above circuit.
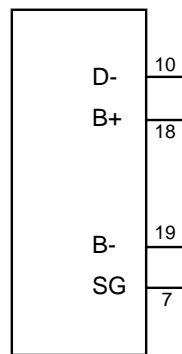
# Interface Test

Connect the test loop plug described below to the interface in order to perform an interface test.

Select **Yes** in the **Diagnostic Test** menu to enable the interface test of the printer.

Canon DB-25S or equivalent plug          (Current Loop)

- Connect the test loop plug to the connector of the serial interface.

- Connect short-circuit jumper SP2 to side B and SP3 to side B to select the Current Loop operating mode. Plug SP4 into side B and SP5 into side A to activate the interface connection with two transmission lines and a power source on the printer side. This circuit is equivalent to diagram 7.



(Current Loop)

- Turn the printer on. The printer buffer, interface driver and receive loop functions on the serial interface are now tested. On completion of this test all characters are printed in a test pattern.

The result is printed as follows:

The message `CORESIDENT SERIAL I/F F/W xx.xx YR4064-1578 LOOP TEST` will be printed, where xx.xx is replaced by the current ROM version.

The printer checks the buffer and prints `RAM = GOOD`, if no error occurred or `RAM = BAD`, if an error occurred during the memory test.

The signal logic is also tested. The message `CURRENT LOOP I/F = GOOD` is printed if no error was detected. If an error occurred, the message `CURRENT LOOP I/F = BAD` is printed.

Contact your local dealer, if the message `CURRENT LOOP I/F = BAD` is printed.

From the printer's send loop, hexadecimal characters from 20H to 7FH are transmitted into the receive loop. These characters are stored in the buffer and printed.

This process is repeated until the printer is turned off. The printer returns to normal operation when you set the **Diagnostic Test** menu option to **No**.

To set the printer to menu mode while the **Diagnostic Test** option is set to **Yes**, hold the menu key down while switching the printer on.

# ML 390FB Serial Interface Specifications

## RS-232C Serial Interface
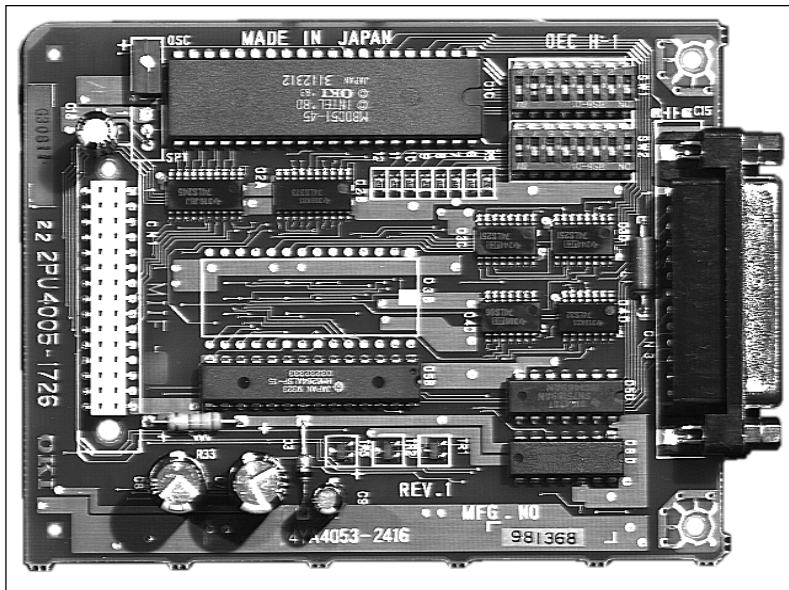
In a serial interface the bits of a byte are transmitted consecutively. Additional lines are used to control the data transmission. This type of connection is often used with networks. Using a serial interface large distances can be covered without any disturbances.

When using a serial interface, correct wiring as well as correct setting of the interface parameters is of paramount importance.

For most applications the default settings are sufficient. Occasionally you might have to change some parameters. Never change values which are not described in your computer or network manual.

The technical data of a cable for a serial RS-232C-interface:
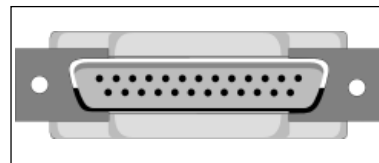
25-pin plug: equivalent to DB25P
Plug housing: equivalent to DB-C2-J9.

Shielded Beldon cable or equivalent cable with a maximum length of 15 m. The cable used should be a twisted-pair cable to prevent signal interference.

The cable must be UL-certified and CSA-certified. The printer has a 25-pin DB-25S-connector.

*Interface connection on printer side.*

Pin Assignment

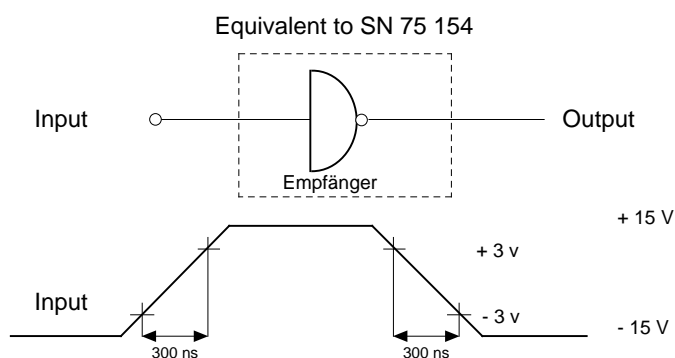| Pin | Signal | Direction | Description |
|---|---|---|---|
| 1 | Protective Ground, FG | ---- | Connected to printer´s frame. |
| 2 | Transmit Data, TD | from printer | Data signal sent from printer. |
| 3 | Receive Data, RD | to printer | Serial data signal received by printer. |
| 4 | Ready to Send, RTS | from printer | Printer can receive data. This pin can be used as output line for the printer´s Busy signal with the Ready/Busy protocol, if switch SW1-7 is set to ON and switch SW1-8 is set to OFF. A Low-level signal indicates that data cannot be received. High-level indicates that the printer is ready to receive data. |
| 5 | Clear to Send, CTS | to printer | Indicates that the system is ready to send data to the printer. |
| 6 | Data Set Ready, DSR | to printer | Is evaluated by the printer, if switch SW2-4 is set to ON. This signal is used as input circuit only with those systems that send a DSR signal. When using any other system, you have to disable the signal by setting the switch SW2-4 to OFF . |
| 7 | Signal Ground, SG | ---- | Signal Ground. |
| 8 | Carrier Detect, CD | to printer | Signal confirms correctness of data to be sent. |
| 10 | | | Not assigned. |
| 11 | Flow Control, SSD | from printer | Can be used for the Busy signal sent from printer, when the Ready/Busy protocol is used. When switch SW1-7 ist set to OFF and SW1-8 is set to ON, SSD is the Low-level Busy-line of the printer, when the printer is not ready to receive data. When the switches SW1-7 and SW1-8 are set to OFF, SSD is the high-level Busy-Line, when the printer is not ready to receive data. |

| Pin | Signal | Direction | Description |
|-----|--------|-----------|-------------|
| 12-19 | | | Not assigned. |
| 20 | Data Terminal, DTR | from printer | This signal can also be used Ready as Busy signal for the Ready/Busy protocol to indicate that the printer is ready to receive data. If SW1-7 and SW1-8 are set to ON, the signal DTR is selected as output line for the Busy signal. If the signal is low-level, it is not possible to receive data. A high-level signal indicates that the printer is ready to receive data. In this case the position of switch SW2-7 has no effect on the signal DTR. If the SSD or the RTS signal is used as output line for the Busy signal in the Ready/Busy protocol, the DTR signal is constantly high-level as soon as the printer is turned on if SW2-7 is set to ON. If SW2-7 is set OFF, the signal is high-level when the printer is set on-line. The DTR signal is low-level when the printer is set off-line. |
| 21-25 | | | Not assigned. |

MARK Polarity:   -3 to -15V:   LOW = OFF = Logical „1"
SPACE Polarity:   +3 to +15V:   HIGH = ON = Logical „0"

Signal Level

Circuits

**Input circuit**



Equivalent to SN 75 154

Input — Output

Empfänger

Input

+ 15 V
+ 3 v
- 3 v
- 15 V

300 ns      300 ns

**Output circuit**

Equivalent to SN 75 188

Input

Sender

○ Output

Output

+ 9 V

+ 3 V

- 3 V

- 9 V

300 ns

300 ns
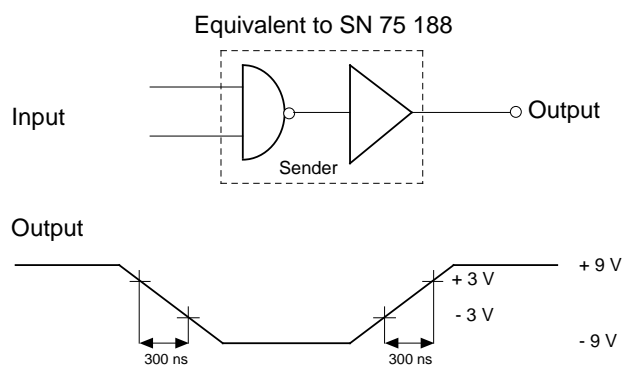
# Settings on the Board

*Always change a DIP switch with the printer turned off. When turning the printer on, the DIP switch settings are determined by the printer. Changed settings will not be applied in the current print session.*

The 16 switches of the serial interface are arranged in two adjacent rows of switches. They are called SW1 (DIP switch row 1), switch 1-1 to 1-8 and SW2 (DIP switch row 2), switch 2-1 to 2-8.
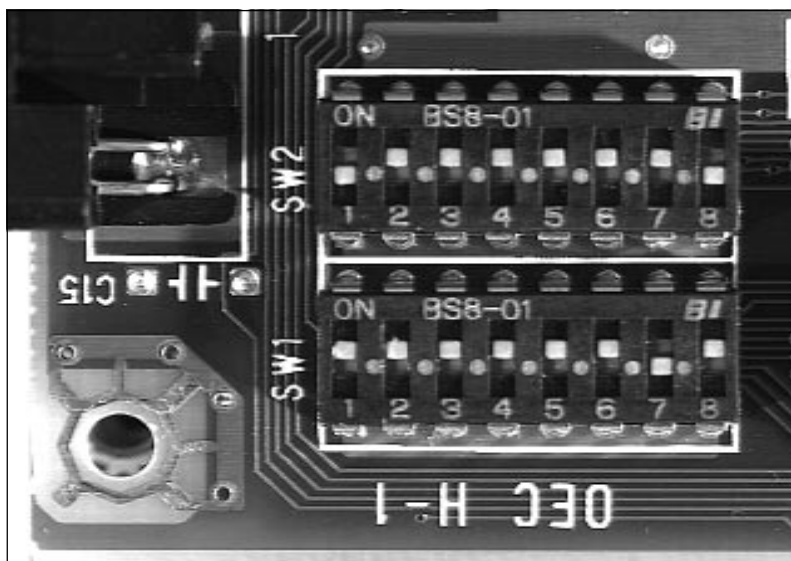
The function of short-circuit plug SP1 is defined by the position of the short-circuit jumper.  If the two contacts pointing towards the EPROM socket are connected, the CPU´s program memory is enabled. If the contacts pointing towards the CPU are connected, the CPU´s program memory is disabled, and an EPROM with an appropriate interface control program has to be installed in the board´s socket.

The following overview shows the DIP switches, their default setting and their functions:

| **Switch 1-1** | **OFF** | **ON** |
| --- | --- | --- |
| Parity | even | **odd** |

DIP switches row 1

*The default settings of the DIP switches are printed in bold.*

This switch has to be set to OFF, when serial transmission with even parity is used. The switch has to be set to ON, when serial transmission with odd parity is used. The setting of the switch is irrelevant, when data is transmitted without adding a parity bit.

| **Switch 1-2** | **OFF** | **ON** |
| --- | --- | --- |
| Parity | with | **none** |

Set this switch to OFF, if the system adds a parity bit to the data byte. Set this switch to ON, if data transmission is serial without adding a parity bit.

| **Switch 1-3** | **OFF** | **ON** |
| --- | --- | --- |
| Data format | 7 Bit | **8 Bit** |

This switch has to be set to OFF when data is serially transmitted using the 7-bit format. It has to be set to ON, when data is transmitted using the 8-bit format.  It is not possible to send data using the 7-bit format without parity bits.

| **Switch 1-4** | **OFF** | **ON** |
| --- | --- | --- |
| Protocol | X-OFF/X-ON | **Ready/Busy** |

This switch has to be set to OFF, when the X-ON/X-OFF protocol is used for the serial transmission of data. The switch has to be set to ON, when the Ready/Busy protocol is used.

| Switch 1-5 | OFF | ON |
|---|---|---|
| Test mode | Hexdump test | **Circuit test** |

When this switch is set to OFF, the monitor test of the serial port is selected. When the switch is set to ON, the connection test is selected. This self test can be performed with a test plug.

| Switch 1-6 | OFF | ON |
|---|---|---|
| Mode | Diagnostics | **normal** |

If you want to carry out an interface test with the switch 1-5, this switch has to be set to OFF. For normal printing operation this switch has to be set to ON.

| Busy Line | Switch 1-7 | Switch 1-8 |
|---|---|---|
| DTR (Pin 20: - 9 V) | ON | ON |
| RTS (Pin 4: - 9 V) | ON | OFF |
| **SSD (Pin 11: - 9 V)** | **OFF** | **ON** |
| SSD (Pin 11: + 9 V) | OFF | OFF |

These switches determine the output line for the Busy signal. Line 20 (DTR) is used for the Busy signal when switches 1-7 and 1-8 are set to ON. The printer is not ready when the transmitted signal is low-level.

Line 4 (RTS) is used for the Busy signal, when switch 1-7 is set to ON and switch 1-8 is set to OFF. The printer is not ready when the signal is low-level.

Line 11 (SSD) is used for the Busy signal, when switch 1-7 is set to OFF and switch 1-8 is set to ON. The printer is not ready when the signal is low-level.

Line 11 (SSD) is used for the Busy signal, when switch 1-7 is set to OFF and switch 1-8 is set to OFF. The printer is not ready when the signal is high-level.

To select the baud rate of the serial interface, use the following switches. For the position of the switches and the baud rate values, refer to the table below.

| Transmission rate | 2-1 | 2-2 | 2-3 |
|---|---|---|---|
| 19.200 Baud | ON | ON | ON |
| **9.600 Baud** | **OFF** | **ON** | **ON** |
| 4.800 Baud | ON | OFF | ON |
| 2.400 Baud | OFF | OFF | ON |
| 1.200 Baud | ON | ON | OFF |
| 600 Baud | OFF | ON | OFF |
| 300 Baud | ON | OFF | OFF |
| 110 Baud | OFF | OFF | OFF |

DIP switch row 2

| Switch 2-4 | OFF | ON |
|---|---|---|
| DSR-signal | invalid | **valid** |

If the DSR signal is not used by the system, this switch has to be set to OFF. If the system does use this signal, the switch has to be set to ON.

| Switch 2-5 | OFF | ON |
|---|---|---|
| Buffer threshold for Busy signal | 256 bytes | **32 bytes** |

This switch determines the buffer threshold of the serial interface. When the threshold limit is reached, a Busy signal is sent from the printer. If the switch is set to OFF, the printer sends a Busy signal when the remaining buffer capacity is less than 256 bytes. If the switch is set to ON, a Busy signal is sent at a capacity of less than 32 bytes. In order to avoid loss of data, choose a buffer threshold of 256 bytes. However, the capacity of the buffer is higher when 32 bytes is selected.

| Switch 2-6 | OFF | ON |
|---|---|---|
| Minimum time period for Busy signal | 1 s | **200 ms** |

This switch determines the period of time for the Busy signal. The signal is set to 1 second when this switch is set to OFF. The signal is set to only 200 milliseconds when this switch is set to ON.

| Switch 2-7 | OFF | ON |
|---|---|---|
| Function of DTR signal | High-level, after turning printer on. | **High-level, when printer is ON LINE.** |

This switch determines the function of the DTR signal. With the switch set to ON, the DTR signal is constantly high-level as soon as the printer is turned on. If you set this switch to OFF, the DTR-signal is high-level when the printer is set on-line. The DTR signal is low-level when the printer is set off-line.

| Switch 2-8 | OFF | ON |
|---|---|---|
| Not used | OFF | ON |

This switch is not assigned.

## Transmission Protocol

For serial data transmission you can choose one of two protocols by using switch SW1-4:

READY / BUSY

The Busy signal is enabled (BUSY) when there are less than 256 or 32 bytes (depending on the switch setting SW2-5) of space available in the interface buffer. After 200 ms or 1 second (depending on the switch setting SW2-6) the signal is deactivated (READY), if no capacity can be made available within this time. If more than 200 ms or 1 second is needed for processing the data stored in the buffer, the signal is immediately disabled (READY) as soon as there is sufficient capacity available.

X-ON / X-OFF

This protocol uses the ASCII characters DC3 (decimal 19) and DC1 (decimal 17) for the control of data transmission. As soon as there are less than 256 or 32 (depending on the switch setting SW2-5), a DC3 command informs the sender that no more data can be received. The command DC3 will be sent as long as there is data sent by the system. If all the data in the buffer can be processed within 200 ms or 1 second after a DC3 signal has been sent, a DC1 signal indicates 200 ms or 1 second after sufficient capacity has been made available, the ability to receive data. If it takes more than 200 ms or 1 second, the command DC1 is sent as soon as there is sufficient capacity available.
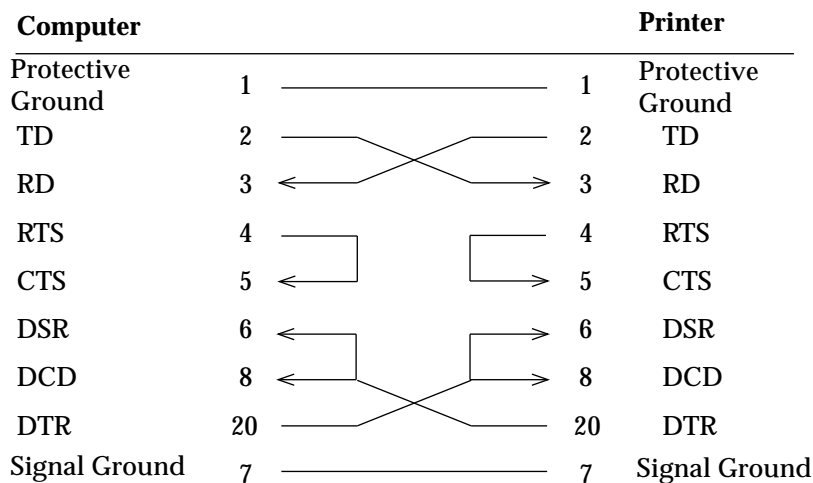
The Busy Time setting of 200 ms or 1 second for both protocols is determined by the switch SW2-6.

# Interface Wiring

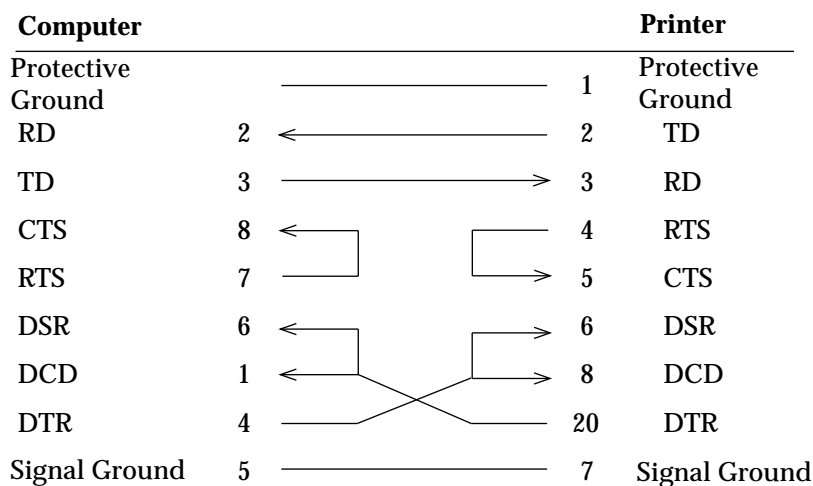The following circuits assume that printer and computer are used as terminals (DTE).

### Ready / Busy Protocol

For »Ready to Receive« you can select the line **DTR, SSD+, SSD-** or **RTS** in the menu **Busy Line**.

| Computer | | | | | Printer |
|---|---|---|---|---|---|
| Protective Ground | 1 | — | 1 | | Protective Ground |
| TD | 2 | ⤬ | 2 | | TD |
| RD | 3 | | 3 | | RD |
| RTS | 4 | | 4 | | RTS |
| CTS | 5 | | 5 | | CTS |
| DSR | 6 | | 6 | | DSR |
| DCD | 8 | ⤬ | 8 | | DCD |
| DTR | 20 | | 20 | | DTR |
| Signal Ground | 7 | — | 7 | | Signal Ground |

PC industry-standard
25-pin to 25-pin

*When using this suggestion, set the menu option Busy Line to DTR and Protocol to Ready/Busy. If you selected the X-ON/X-OFF protocol, the setting for Busy Line is irrelevant. The value DSR in the printer menu should be set to Invalid.*

| Computer | | | | | Printer |
|---|---|---|---|---|---|
| Protective Ground | | — | 1 | | Protective Ground |
| RD | 2 | ← | 2 | | TD |
| TD | 3 | → | 3 | | RD |
| CTS | 8 | | 4 | | RTS |
| RTS | 7 | | 5 | | CTS |
| DSR | 6 | | 6 | | DSR |
| DCD | 1 | ⤬ | 8 | | DCD |
| DTR | 4 | | 20 | | DTR |
| Signal Ground | 5 | — | 7 | | Signal Ground |

AT industry-standard
9-pin to 25-pin

*When using this suggestion, set the menu option Busy Line to DTR and Protocol to Ready/Busy. If you selected the X-ON/X-OFF protocol, the setting for Busy Line is irrelevant. The value DSR in the printer menu should be set to Invalid.*
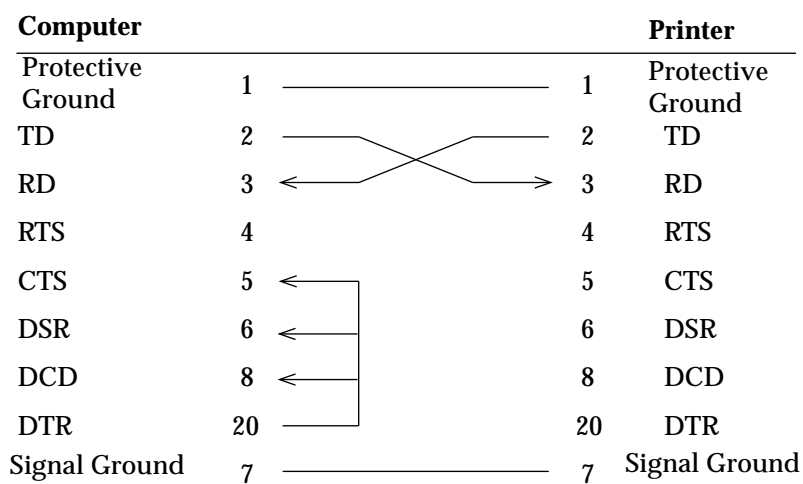
*It is not possible to give a definitive statement about the circuits on computer side.*

## X-ON / X-OFF Protocol

If any problems occur when using the X-ON/X-OFF protocol with these circuits, use the following circuit. Please note that it is assumed that the DTR signal is set to SPACE on the computer. This circuit does not support the Ready/Busy protocol.
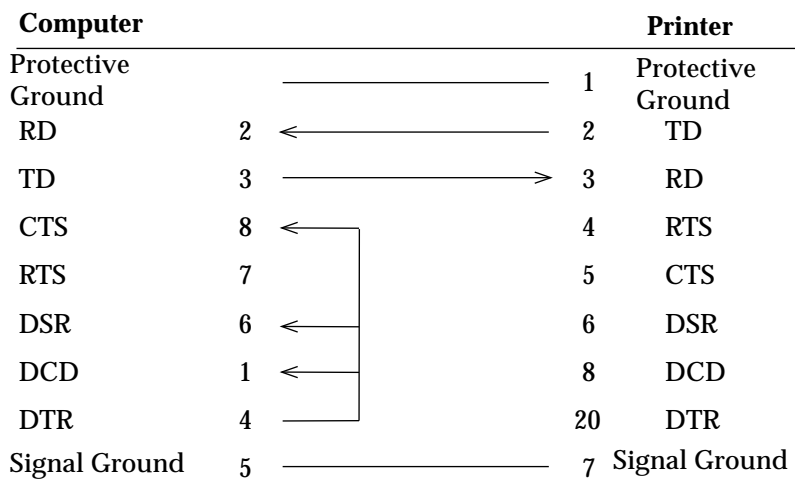
**PC industry-standard 25-pin to 25-pin**

*Ensure that the printer menu option DSR is set to Invalid.*

| Computer | | | Printer |
|---|---|---|---|
| Protective Ground | 1 | —————— 1 | Protective Ground |
| TD | 2 | 2 | TD |
| RD | 3 | 3 | RD |
| RTS | 4 | 4 | RTS |
| CTS | 5 | 5 | CTS |
| DSR | 6 | 6 | DSR |
| DCD | 8 | 8 | DCD |
| DTR | 20 | 20 | DTR |
| Signal Ground | 7 | —————— 7 | Signal Ground |

**AT industry-standard 9-pin to 25-pin**

*Ensure that the printer menu option DSR is set to Invalid.*

| Computer | | | Printer |
|---|---|---|---|
| Protective Ground | | —————— 1 | Protective Ground |
| RD | 2 | ←—————— 2 | TD |
| TD | 3 | —————→ 3 | RD |
| CTS | 8 | 4 | RTS |
| RTS | 7 | 5 | CTS |
| DSR | 6 | 6 | DSR |
| DCD | 1 | 8 | DCD |
| DTR | 4 | 20 | DTR |
| Signal Ground | 5 | —————— 7 | Signal Ground |

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# Interface Test

When the serial interface is connected with the plug stated below and switch SW1-5 is set to ON and SW1-6 is set to OFF, a test of the serial interface is automatically carried out when the printer is turned on. The result will be printed.

Canon DB-25S

```
         TD   | 2
         RD   | 3
        RTS   | 4
        CTS   | 5
         CD   | 8
        SSD   | 11
        DTR   | 20
        DSR   | 6
```

(RS-232C)

This process is repeated as long as the printer is turned on. On completion of this test the switch SW1-6 must be reset to **ON** and all other switches must be set according to the system requirements.
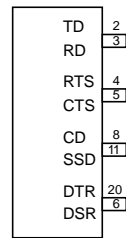
The printout of the hexdump test of the RS-232C interface is similar to the printout of the hexdump mode of the printer. When performing these tests the printer also verifies whether baud rate, parity and data bits have been set correctly.

You enable the hexdump test by setting switches SW1-5 and SW1-6 on the board to OFF. When turning the printer on, all data sent to the printer will be printed in hexadecimal characters. If the data sent to the printer is not printed in the corresponding hexadecimal characters, one or more switches are set incorrectly.

Printer does not print:

● Are the print instructions correct?

● Is the cable securely connected?

● Is the wiring of the interface cable correct?

● Is the printer turned on?

● Is switch SW2-4 set to ON (DSR enabled), although the DSR input of the printer is not connected to the correct output or is this signal not supported by the system?

»PARITY ERROR« is displayed. The system´s port configuration does not correspond to the printer´s baud rate, parity or data format. Refer to your system´s documentation or the configuration file of your operating system to check your system´s port configuration.

Adjust the printer interface to these parameters by setting switches SW1-1 and SW1-2 (parity) and SW2-1 to SW2-3 (baud rate), SW1-3 (data format) and SW 2-1 to SW 2-3 (transmission rate) according to the parameter values required by your system.

The interface protocol and/or the Busy line is set incorrectly if these error message are only printed after several lines or pages. Possibly the interface cable is incorrectly configured and the printer is unable to communicate to the system that the printer buffer is full.

Determine the transmission protocol of your system and configure your printer interface accordingly using switch SW1-4. Check the configuration of your interface cable and select the Busy setting accordingly using switches 1-7 and 1-8.

The first interface should now be configured correctly. Use the hexdump display to check the data and the control commands sent. Each byte is now printed in its hexadecimal format.

If the problem during serial data transmission persists, perform a self-test on the serial interface.

On completion of this test, turn the printer off and set switch SW1-6 back to ON.

**OKI Europe Ltd.**

Central House
Balfour Road, Hounslow
Middlesex TW3 1HY
United Kingdom
Tel:  + 44 (0) 181 219 2190
Fax: + 44 (0) 181 219 2199

**OKI Systems (Deutschland) GmbH**

Hansaallee 187
40549 Düsseldorf
Tel:  + 49 (0) 211 5266-0
Fax: + 49 (0) 211 593345
BBS: + 49 (0) 211 596896 (ISDN, X.75)
     + 49 (0) 211 5266-222 (analog)
     300-28800 bps, 8, N, 1
T-Online/Btx: *222333#

**OKI Systems (UK)  Ltd.**

550 Dundee Road
Slough Trading Estate
Berkshire SL1 4LE
United Kingdom
Tel:  + 44 (0) 753 819819
Fax: + 44 (0) 753 819899

**OKI Systems (Ireland) Ltd.**

The Square Industrial Complex
Tallaght,
Dublin 24
Ireland
Tel:  + 353 (0) 1 459 8666
Fax: + 353 (0) 1 459 8840

**OKI Systems (Belgium)**

Leuvensesteenweg 542 bus 22
1930 Zaventem
Belgium
Tel:  + 32 (2) 7160 550
Fax: + 32 (2) 7253 628

**OKI Systems (Holland) b.v.**

Kruisweg 765  Postbus 690,
2132 NG (2130 AR)
Hoofddorp
The Netherlands
Tel:  + 31 (0) 20 6531531
Fax: + 31 (0) 20 6531301

**OKI Systèmes (France) S.A.**

40-50,  Av. Général de Gaulle
94240 L´Haÿ les Roses
France
Tel:  + 33 (1) 46158000
Fax: + 33 (1) 41240040

**OKI Systems (Italia) S.p.A.**

Centro Commerciale "Il Girasole"
Palazzo Cellini - Lotto 3.05/B
20084 Lacchiarella (Milano)
Italy
Tel:  + 39 (0) 2 90076410
Fax: + 39 (0) 2 9007549

**OKI Systems (España)**

C/Goya 9
Madrid 28001
Spain
Tel:  + 34 (1) 5777336
Fax: + 34 (1) 5762420

**OKI Systems (Norway) A/S**

Hvamsvingen 9
PO Box 174
2013 Skjetten
Norway
Tel:  + 47 (0) 638 93600
Fax: + 47 (0) 638 93601

**OKI Systems (Sweden) AB**

Stormbyvägen 2-4
PO Box 131,
163 55 Spånga
Sweden
Tel:  + 46 (0) 8 7955880
Fax: + 46 (0) 8 7956527

**OKI Systems (Danmark) a.s.**

Parkalle 382
2625 Vallensbæk
Denmark
Tel:  + 45 (0) 43 666500
Fax: + 45 (0) 43 666590

**OKI Europe Ltd.**

Branch Office (Prague)
IBC, Pobrezni 3
186 00 Praha 8
Czech Republic
Tel:  + 42 (2) 2326641, ~ 42
Fax: + 42 (2) 2326621

**OKI Europe Ltd.**

Branch Office (Poland)
UL Grzybowska 80-82
00840 Warsaw
Poland
Tel:  + 48 (2) 6615407
Fax: + 48 (2) 6615451

**OKI Europe Ltd.**

Europa Center
Karoly (Tanacs) KRT 11 5A
1075 Budapest
Hungaria
Tel:  + 36 (1) 2697871, ~ 73
Fax: + 36 (1) 2697872

# OKI
People to People Technology

**Oki Data Corporation**

4-11-22, Shibaura, Minato-ku,
Tokyo 108, Japan